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COMMERCIALIZATION OF RESEARCH RESULTS AT NATIONAL LEVEL INCLUDING LINKING MECHANISM BETWEEN INDUSTRIAL RESEARCH INSTITUTIONS AND INDUSTRY*

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INTRODUCTION

The CISIR is today Sri Lanka's leading multidisciplinary research institution. The technical work of the institute is divided among the following sections :

Agro Industries
Analytical Chemistry
Applied Physics and Electronics
Environmental Monitoring and Pollution Control
Fats and Oils
Food Technology
Industrial Microbiology
Minerals Technology
Natural Products
Pilot Plant and Designs
Rubber Technology
Wood and Cellulose Technology

These Sections are staffed with about 30 senior scientists and engineers having post-graduate qualifications and in equal number of younger graduates. Provision exists for 25 more research officers but recruitment is difficult because salaries and other benefits at research institutions are lower than in manufacturing and trading organisations within the public sector itself. As a consequence staff turn-over is high. Fortunately we have been able to retain a core of qualified and experienced staff members who are willing to forego

financial advantages for job satisfaction.

The institute received for 1984 a government grant of Rs. 7 million (US $ 280,000) for current expenditure and Rs. 6 million (US $ 240,000) for capital expenditure which includes equipment, books and periodicals.

The institute was established in 1955 as a condition to the grant of a World Bank loan. The services of the first director were provided by the World Bank. He had worked at the Armour Foundation in the U.S. and had established an industrial research institute in Mexico. On the basis of this experience he was confident that if the government of Ceylon (as Sri Lanka was then known) provided a grant of Rs. 5 million in five yearly instalments of Rs. 1 million each, the institute would be self sufficient at the end of the 5 year period. In the event, however, even at the end of 5 years CISIR was earning less than 20 per cent of its expenditure. This failure was due to two main reasons. Firstly, the core staff of 6 research officers of the institute could not between themselves muster expertise in the several disciplines needed to serve industry. There was a strong bias towards chemistry while the area of engineering was weak. This imbalance has continued to the present day and is a major constraint to the development of technologies at CISIR. Secondly, industry in our country was then in its infancy and very few senior managers in industry then understood how to utilise the services that the institute provided.

The powers and duties of the institute are vested in a Governing Board which includes representatives of government ministries and private industry. In the early years of its existence the institute enjoyed a great deal of freedom. This autonomy has gradually been eroded and today many of the important decisions of the Governing Board are subject to approval by the Ministry of Industries and Scientific Affairs. The sale of technologies developed at CISIR is one of the subjects that are governed by Ministry directives.

Where the work has been commissioned and paid for by a client the rights to the exploitation of the technology including any patents belong exclusively to the client. Such an agreement was signed between the CISIR and the State Trading Corporation (Consolidated Exports) for R and D work on spices. In drafting this agreement we found a great deal of useful information in the UNIDO publication "Industrial Research Institutes" (Vienna, 1970).

Annex 3 : "Form of Agreement Between an Industrial Research Institute and A Client Sponsoring A Research Project" was particularly useful. The agreement signed by us is of the umbrella type allowing for several individual projects. A separate schedule has to be signed for each project. A schedule has recently been signed for the first project assigned under this agreement.

Technologies developed at CISIR through projects initiated at CISIR are commercialised in accordance with guidelines laid down

in Ministry directives. These require the technologies to be advertised in the newspapers and sold on a non-exclusive basis. The offers received are now scrutinised by a Contracts Committee appointed by the Governing Board which is composed of some members of the Governing Board and some senior officers - director, deputy director, head of the section which developed the technology, Chief Accountant and Head of the Section of Industrial Economics.

The criteria for the award of the rights to the technology have varied from time to time. During the period 1970 - 1977 state corporations received priority in the award of technology rights. In addition they made no payment for the technology. Not only was the institute thereby deprived of revenue rightly due to it but the officers involved in the development of the technology were denied payment of the appropriate part of the royalty normally paid to them. It also generally resulted ultimately in the non-exploitation of the technology, as happened in the case of the process for the manufacture of sodium alginate from sea weed which had been developed at the laboratory bench scale at CISIR. The institute had finalised arrangements for the sale of this technology to a private sector organisation which was already involved in the manufacture of a number of products based on local raw materials. This organisation also had links with a well known transnational corporation involved in chemical processing. The National Textile Corporation then claimed that the technology should be handed over to them on the grounds that they were the ultimate users of the alginate. The Ministry ruled that the technology should be given to the Textile Corporation. This Corporation had no experience in scaling up chemical

process as did the private sector organisation. After some attempts at scaling up had failed they abandoned the project a couple of years later. By that time there was a change of government with changes in overall economic policy. The subsequent liberation of imports led to free imports of alginate at prices which could not be matched by any local manufacturer.

It has also been our experience that sale of the technology to the highest bidder also has serious limitations. The following case explains this statement. A client brought a sample of coconut paste made abroad and asked whether the institute could make a product to match. We were in the happy position to inform him that just such a product had recently been developed at CISIR. The client offered terms for purchase of the technology. Being debarred from accepting this offer directly the Contracts Committee sought direction from the Governing Board. The Board decided that normal procedure should be followed and the process advertised. Among the responses to the advertisement was one which offered much higher payment than the earlier client had offered. By the time the decision was made to offer the process to the higher bidder the latter had lost interest in this process and invested his money in a venture that held out higher financial rewards. When the process was offered to the client who had first approached the instititute he replied that he had arranged to obtain the technology from other sources. The CISRI developed technology is today lying on the shelf.

Another problem we have encountered is that of granting exclusive rights to use a CISIR-developed technology. The Ministry had

earlier directed CISIR to advertise all CISIR processes on the basis of non-exclusive manufacturing rights on the grounds that as a government sponsored organisation CISIR should make its processes readily available to all industrialists and entrepreneurs on the same basis of payment. Some processes are however difficult to sell on a non-exclusive basis. The market is sometimes too small to support more than one manufacturing unit. Sri Lanka has a population of 15 million and a Per Capita GNP of about US $ 284 at current prices. The product itself may be new and has to be introduced into the market. No industrialist would be willing to spend on advertising a new product and bestow the benefits of his pioneering labours free of charge on a competitor entering the field. The grant of exclusive use of CISIR-developed technologies on an exclusive basis for a limited period of a few years is therefore considered in the above cases. The advertisement now carries the following clause :

> "The policy of the Institute is to offer the process it has developed for sale on a non-exclusive basis. However, applications for exclusive purchase of CISIR technologies for limited periods will be considered in special cases".

A major problem faced by the institute in collecting the royalties due to it is caused by our inability to investigate infringements of our rights. Sometimes a small manufacturer may pay us royalties for a couple of months for use of know how he has obtained from us. Then he informs the institute that he is no longer using the know how he has obtained from us as he has obtained improved technology from

elsewhere. We are therfore now forced into the position where we do not count for certain on obtaining royalty payments but try to obtain the maximum down-payment at the time of signing the agreement.

Past experience has also shown us as it has, I believe, shown all others, that it is a risky operation to attempt pilot plant trials on one's own, particularly in the context of a liberalised economy. We therefore now proceed to pilot plant studies if the technology is simple, if we already have the equipment and if the amount of money involved is small. We now insist that once a process is developed at the laboratory bench scale that the technology so worked out must be described in a written report. Even prior to the completion of the laboratory work, when the process first appears be commercially attractive and worthy of scaling up, the engineers of the Pilot Plant Section should be invited to be associated with the project. Once the final laboratory report is ready the scientists who developed the process are required to sit down with their counterparts in the Section of Industrial Economics and prepare a report on the economic feasibility of the report. We then advertise the process inviting industrial partners for collaboration in scaling up the process. The industrialist or entrepreneur at this stage must be provided with the technical and economic feasibility reports. Any shortcomings in these evaluations are apt to put off the industrial, as we found to our cost recently. Once confidence in the institute is shaken it is a difficult task to restore it. The advantages in bringing in an industrial partner are many. Firstly, it indicates

it indicates whether the commercial prospects of the process developed are promising. If the response to the notice calling for an industrial partner is poor, proceeding to pilot plant studies on our own must be done after a most searching study The other advantages of an industrial partner include the following (1) We may already have experience of operating in the same or a related field so that the services of personnel experienced in the particular field of work are available (2) He may have the equipment or some similar equipment that can be modified for the purpose (3) The costs are both reduced and shared so that the risk borne by the institute are correspondingly reduced.

The total number of technologies developed at CISIR over the nearly thirty years of its existence has been small compared to the number of projects begun. The number of processes that have been commercialised is even fewer. I have read or heard it said that on a world-wide estimate only about one per cent of the projects begun finally result in successful commercial ventures. We believe that the greatest care should be given to the selection of research projects. Earlier each research officer or the Head of his Section chose the subject of each research project. Now after some preliminary laboratory and market investigations a formal research proposal is submitted to our Research Planning Council. This proposal must have an economic evaluation made by the Head of Section in collaboration with the Section of Industrial Economics. Formal laboratory work begins and costs are maintained only after approval of the proejct by the Research Planning Council. As earlier mentioned

a second economic evaluation of the process is made after laboratory studies are completed and a third after Pilot Plant studies.

One point I would like to emphasize is that money spent on research projects that failed to give commercial results is NOT wasted money. A great deal of useful information is obtained in the course of such studies and the research workers add to their fund of experience. Perhaps the following story concerning Thomas Alva Edison, the great American inventor would illustrate my point better.

"Thomas Edison was mocked for trying unsuccessfully some twelve hundred materials for the filament of his great dream, the incadescent light bulb. "You have failed twelve hundred times", said a regimented thinker of that day. "I have not failed", countered Edison. "I have discovered twelve hundred materials that won't work".*

Another approach suggested to our Governing Baord to the problem of exploiting industrial processes developed at CISIR is referred to as the Entrepreneur Development scheme. Here the group of R and D personnel who developed the process would be encouraged to commercially exploit the process. The institute would recommend to the development financing institution that the entrepreneur or entrepreneur group composed of the R and D staff that developed the project would be financially assisted to start and continue production.

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* James C. Humes, Speaker's Treasury of Anecdotes about the Famous (New York, Harper and Row, 1978).

The institute would continue to provide technical assistance in the way of factory trouble shooting, quality control and improvement of the technology. It is hoped by this scheme to provide incentives for determined and sustained effort in the development of technologies. Further, it has been suggested by proponents of the scheme, that no one would be as motivated in making a commercial success of a process as the person or the group of persons who developed it.

Two case studies of successful exploitation of processes developed at CISIR and two case studies of technologies that held much promise but could not be commercialised are presented at the end of this paper.

As we proceed to study the subject of transfer of technologies developed in our research institute we have come across the undermentioned questions. I hope that the discussion of these questions in this forum will provide the answers, even in a general way to the problems of technology commercialisation by institutions like our own CISIR.

(1) What should be the deciding factors in the selection of a licensee to exploit an industrial process developed at a research institute?

(2) How are the conditions of payment (both initial down-payment and recurring royalty) determined?

(3) What should be the basic features of a scheme of incentives to R and D workers for the development of industrial technologies?

CASE STUDY I

REPLACEMENT OF THE INSULATING LINING OF ELECTROLYTIC CELLS USED IN THE MANUFACTURE OF CAUSTIC SODA

The caustic soda plant established at Paranthan in the early fifties was one of the early government industrial ventures. The technology was outdated even at the time the plant was purchased from an European company which ceased operations a few years later. The plant was owned and operated by the Paranthan Chemicals Corporation. There was a delay of several years in erecting the plant and problems in commissioning it. Shortly afterwards it was found that the ebonite insulating layer was failing in a number of cells.

Each cell consisted of a grooved bar of steel as the horizontal member each end of which carried a similarly grooved member. The vertical arms were about 4 feet high while the horizontal member was about 10 feet long. The grooves were about 4 inches deep and had a thin insulating lining of ebonite. The electrolyte solution was carried in the groove. Once deterioration of the ebonite lining began the chlorine produced in the electrolyte solution attacked the steel material of the cells.

At this time the corporation being already in financial difficulties had no funds to buy new electrolytic cells nor to have the defective one reconditioned abroad. In this desperate situation the CISIR was requested to "try out anything because closure of the plant appeared imminent". At CISIR the task was handed over to the Rubber Technology Section of which I was head.

If we had a large enough autoclave to accomodate the cells laying on a new layer of ebonite would not have been too difficult a task. But we had no autoclave so large. The vulcanising condtiions for the compound we had formulated were 5 hours at 150°C.. The only alternative available to us therefore was vulcanising in hot water. On a rough calculation confirmed by laboratory trials vulcanising in (boiling) water at 100°C would need

a reaction time of 160 hours - nearly one week. Yet we had to resort to this method.

Our workshop had a car servicing pit. We built up the sides of pit to a ight of about 4 feet to give a head of about one metre of water above the electrolytic cell. To maintain the temperature above the the boiling point of water we tipped in about 50 lb. of crude common salt into the bath of water. The electrolytic cells were lowered into the bath and steam passed into the water to raise the temperature gradually to boiling point. The steam supply was then disconnected. The drop in temperature overnight was only about $3^{o}C$ and steam was therefore blown in each morning and evening to raise the temperature of the bath to boiling point. After one week the rubber composition was found to be well vulcanised and an even layer of ebonite had formed. No cracks or pinholes were detected when spark-tested. The slow vulcanising over a number of days had permitted the dissipation of the heat evolved during the strongly exothermic reaction producing ebonite. Since the ebonite layer was to function as electrical insulation cracks or pinholes could not be tolerated.

Our institute is located in Colombo while the caustic soda plant was at Paranthan about 250 miles away. A lorry could only bring four cell frames at a time as they were quite heavy. We therefore decided to obviate the transport costs by moving the cell-relining process to Paranthan in two stages. In the first stage a concrete vulcanising tank was constructed with a steel lid that could be bottled down. Sheets of rubber compound were made at CISIR and sent by train to Paranthan. At the second stage arrangements were made with a tyre retreading firm only a few miles away from the caustic soda plant to prepare and supply the rubber compound.

This arrangement has been working smoothly for several years now.

THE PRODUCTION OF COCONUT CREAM

The staple diet of Sri Lankans is rice and curry. The curries are nearly always made with coconut "milk" which is the water extract of grated coconut. The prepararion of the coconut milk is a tedious chore for the housewife. In addition the manual squeezing of the grated kernel with added water leaves behind about 30 per cent of the available fat in the solid residue which is thrown away as "coconut refuse" in individual households. CISIR therefore undertook a project to develop a marketable coconut cream that would lessen the tediusness of domestic cooking while at the same time extract much more of the edible fat from the coconut kernel. Centralised processing also offered the advantage of utilising the extracted meal (coconut refuse) for animal feed and the coconut shell for charcoal production.

The basic problems lay in identifying an effective yet inexpensive food stabiliser and a method of sterilising the cream while retaining its flavour. These problems were fairly well tackled and a hygienic and nutritious bottled coconut cream market tested. It received the approval of the Housewives Association. Pilot plant studies were initiated at a desiccated coconut manufacturing plant owned by the government Coconut Processing Board. In testing marketing the product however it was found that though the quality was acceptable the coconut cream did not find ready sales. The price of coconuts was low enough for everyone to afford home preparation of the coconut milk. The more affluent people had servants do their cooking.

In 1982 however an industrialist bought the rights to use this process with the primary aim of exporting bottled coconut cream to the Middle East countries where there were large numbers of immigrant labour from Sri Lanka and other South Asian countries. The prices of coconuts more than doubled during 1983 making the process economically viable and market

demand for the product cannot be satisfied since as yet only trial production is going on using CISIR pilot plant equipment. Just two weeks ago an article in a Sunday newspaper (on 30 September 1984) blamed the CISIR for not having sufficient quantities of this coconut cream on the market. The equipment for factory scale production is either on order from aborad or under fabrication within the country.

In the meantime a US Aid mission has spotlighted the obvious advantages to the country of centralised processing of coconut kernel to produce coconut cream to partially replace domestically prepared coconut "milk". As a result the CISIR jointly with the Coconut Research Institute has been handed the responsibility of developing a product which will be as good as the best available on the international market. Stage I of the project requires preparation of a profile of the domestically prepared coconut milk relating to chemical, physical and economic evaluation cocoaut products available in other countries that could substitute for domestic coconut "milk" and the preparation of the outline of a process to prepare such a product. This stage of the project has been almost completed.

The next stage calls for development work at pilot plant level, if necessary with assistance from institutions abroad. Our officers are visiting institutions abroad that are in a position to offer such assistance. The form that the final set-up for manufacturing coconut cream or a substitute for it is not quite clear yet. It could be based on a few very large units or it could be adjunct to several of the plants that are today manufacturing desiccated coconut. These units have established hygienic conditions in the operating areas and the equipment for manufacturing desiccated coconut is the same as that for making coconut cream up to the point of disintegrating the coconut kernel.

CASE STUDY III - CARBONATED TEA DRINK

Tea, Sri Lanka's principal foreign exchange earner, has been exported as a commodity for over a century. Since the producing countries do not have much control over the pricing of such commodities in international markets and the growing demand for tea among tourists to Sri Lanka, considerable research has been undertaken to develop new products from the tea leaf. The Ceylon Institute of Scientific and Industrial Research (CISIR) initiated research and developed on the manufacture of new products from black tea in November 1968 A laboratory process for the preparation of carbonated tea was ready in 1980 and pilot plant trials were successfully concluded.

WHAT IS CARBONATED TEA

This is a carbonated tea beverage which has been tested both locally and outside Sri Lanka and the reports obtained have been extremely favourable. It is a ready-made iced tea beverage having some of the properties of cola drinks. Such a drink should find a ready market alongside the popular colar drinks.

As compared with cola drinks, it has the following advantages :

(a) It is made form pure fermented tea (manufactured black tea or fresh fermented green tea)

(b) It contains no artificial colouring matter

(c) It contains the various constituents of tea with their therapeutic value - caffeine, vitamins, polyphenols etc.

This beverage is carbonated to give an attractive sparkle, flavoured to give a pleasant taste and filtered to a high polish. The caffeine from the tea leaf gives it refreshing and invigorating properties.

PROMOTION OF THE PROJECT

The pilot plant trials were carried out in co-operation with a leading aerated water manufacturing firm in Sri Lanka, which showed an interest in buying the process, but the CISIR being a government organisation, its Board of Directors was not agreeable to a private arrangement of this nature and decided that the process should be advertised for sale under "Business Opportunities" in the classified columns of the 'Ceylon Daily News', the national daily in the English Language having the largest circulation in the country. However there were no takers and fresh steps had to be taken to sell the process.

The next attempt to sell the process was one year later in 1971, when the CISIR wrote to nineteen firms, who seemed to have some of the facilities required for the manfuacturing process of the new product.

Tea-ko Makes its Debut

One of the smaller mineral water manufacturers was selected from the nineteen firms written to as it was felt that this firm had the facilities and equipment needed for the manufacturing process. An agreement was entered between the CISIR and this company in March 1972. The new carbonated tea drink was introduced into the Sri Lanka market in Janury 1973, under the brandname 'Tea-ko' with a full page advertisement in the Ceylon Daily News.

However there were hardly any sales and no royalty in terms of the agreement was forthcoming to the CISIR. In fact by November the same year production was at a standstill and the CISIR wrote to the firm that no progress at all had been made and suggested termination of the agreement. The firm informed CISIR that the hold up in production was due to non-availability of suitable crown corks and problems with the pasturizing equipment. Ultimately in January 1974 the agreement was terminated.

T-Co of the Ceylon Brewery Ltd.,

Negotiations with the best known brewery in the country to undertake the manufacture of the carbonated tea drink according to the CISIR process commenced in August 1974 and the agreement was entered into four months later. The brewery was to market this drink under the brand name 'T-Co'.

Around this time the economy of the country was at a low ebb. Raw material imports were permitted only on licences issued by the Ministry of Industries and Scientific Affairs and import allocations were subject to considerable cuts. Besides, sugar an important ingredient in the manufacture of T-Co was in short supply and world prices reached levels never heard of before. In Sri Lanka industrial requirements of sugar had to be obtained on permits issued by the Food Commissioner at two and a half times its normal price. This situation had its repercussions on the new venture too, where production was delayed and requests made to the CISIR in January 1975 for sugar and in March 1975 for Sodium Alginate. By December 1975 although the situation in the country had improved sales continued to be poor. The Brewery promoted T-Co in the same manner as their own beers, through Tourists Hotels and liquor shops. As a result the sales of the drink amounted to only about 400 gallons in each of the years 1973 and 1974. As these figures show sales were never on a large scale.

Almost mercifully, the manufacture of this carbonated tea drink at the brewery was stopped on the orders of the government Excise Department which ruled that equipment used for beer manufacture should not be used for processing other materials as they were likely to contaminate the flavour of the beer.

Analysis of the Failure to Make a Successful Commercial Venture of the Process to Manufacture a Carbonated Tea Drink -

We have made a careful study of the reasons for the failure to make a commercial success of the process to manufacture a carbonated tea beverage. In fact it formed a subject of study for a Workshop on Marketing for R and D personnel held in Colombo during October 1978. I shall try to be frank and as objective as possible in presenting this analysis so that a fruitful discussion can follow from which all of us participating in this workshop can benefit

The product made under laboratory conditions was evaluated by professional tea tasters in commercial tea marketing firm and pronounced good. The products of some of the trials carried out were good, others were scarcely palatable. I remember the uncomplimentary remarks made by some of the visitors to the CISIR Exhibition of 1976 where the carbonated tea was sold. On the other hand there were customers complaining of wanting to buy this product as it was much appreciated by their guests, but being unable to buy it. One such person was the Cultural Attache of the French Embassy in Colombo. It was clear that factory process control was inadequate. Inadequate supplies and lack of adequate quality control measures were howerver only a small part of the story.

More fundamental reasons were adduced at the marketing workshop which were not available at the time to CISIR staff members. The soft drinks market is an extremely competitive one of the world over and breaking into it is no easy task. An aggressive and expensive sales promotion campaign is one of the pre-requisites for doing so. The soft drinks market in Sri Lanka is dominated by two firms. One of them holds the Coca Cola franchise and cannot be expected to market a competing product. The other, an old established firm, has been marketing their own brands of soft drinks which are popular throughout the country. They not only have an established name but also advertise their products widely. This company had no soft drink product in the Cola

line of drinks or any substitute either so that when they learnt of the CISIR product they showed interest and made enquiries about the p. .ibility of their manufacturing and marketing. Here then, unknown to the CISIR scientists, was their best chance, perhaps the only chance for successful commercial exploitation of their process for manufacture of a carbonated tea beverage. The project leader was suspicious of the intentions of the company's manager in asking the questions he did. He feared that the company would use the basic information we provided on our process to develop their own technology. His response to the overtures of the company was cool. Rebuffed, the company proceeded on the development of their own version of a soft drink to compete with Coca Cola. One significant feature was that they mounted a vigorous advertising campaign to promote this product, which is now establihsed on the market. The CISIR carbonated tea beverage in our opinion was, as good as this product.

The means adopted by CISIR to sell its technology namely advertising in the classified columns of a daily newspaper would appear amusing today. It read as follows :-

Business Opportunities

Financiers required to promote the manufacture of new Carbonated Tea-based Soft-Drink Beverages. Laboratory Tested Formulas, Patent Pending - Apply P5662 C/o Daily News.

The first company that was licensed to use the CISIR process was a subsidiary of the country's largest biscuit manufacturer. Their venture into aerated water manufacturing was not a success. Apart from the problems of breaking into a market dominated by two well establihsed firms the economic environment did not favour manfac rers of such products like confectionery, biscuits or soft drinks which were classified as non-essential by the government authorities of the day. These difficulties were compounded by internal management problems of the company.

The brewery was selected as the second licensee because beer was also a bottled drink and the bottling and other equipment was being utilised only during part of the time owing to restrictions on the import of raw materials. Here again no sustained or worthwhile effort was made to establish this new product, the carbonated tea beverage named T-Co. Beer was the Company's money earner and rightly received most of the managements attention. As already mentioned the quality of the T-Co varied and supplies were received only sporadically by dealiers. The reason was that T-Co was made only when the equipment was not needed for making beer. The end was predictable.

The Institute itself had several lessons to learn from this failure to successfully commercialise the process for the manufacture of carbonated tea beverage from green tea leaf. I sahll try to enumerate them.

1. In experimenting with a material that is as variable as green tea leaf a statistically determined number of trials (in line with the number of variable) must be carried out both at laboratory and pilot plant levels.

2. Market studies must be carried out at all stages of development.

3. The choice of the correct industrial partner is of paramount importance to the success of the project. Good publicity must be given to the product. The organisation that can make a success of utilising the technology should be given every encouragement to commercialise it.

4. The utiliser of the technology should ensure uniform quality of all batches of the product and regular supplies of it to distributors.

5. New products need to be introduced to the market by appropriate advertising.

How unaware we were then of the real problems involved in the commercialisation of the technology we had developed for the manufacture of carbonated tea can be seen from the fact that we had patented this process in no less than 22 countries stretching from Canada to New Zealand, needless to say at considerable expense. A country which is one of the largest buyers of our tea in the Middle East officially "offered to gradually change over from bulk teas to bottled teas if and when the product is ready for the market". Such were the hopes we generated for our carbonated tea.